CLAIMS

What is claimed is:

1. A method for measuring low-power components of non-coherently sampled test signals that include at least one tone each having a known frequency, comprising:

executing a DFT on the sampled test signal;

modeling spectral components of the at least one tone, including effects of leakage induced by the at least one tone; and

adjusting the DFT by an amount prescribed by the modeled spectral components to provide a substantially leakage-free measure of low-power components of the test signal.

2. A method as recited in claim 1, wherein the step of modeling includes modeling at least one spectral component of the at least one tone.

3. A method as recited in claim 2, wherein the step of modeling accounts for the known frequency of each expected tone and a plurality of known sampling parameters related to sampling the test signal.

4. A method as recited in claim 3, wherein the step of modeling includes applying actual values from the DFT to determine the amplitude each of expected tone in the modeled spectrum.

5. A method as recited in claim 4, wherein the actual values from the DFT correspond to bins of the DFT containing each expected tone.

6. A method as recited in claim 3, wherein plurality of known sampling parameters includes the number of cycles M_i of each expected tone of the test signal within the sample window, the number of samples N within the sample window, and the sampling rate F_s.

7. A method as recited in claim 6, wherein the modeled spectral components have substantially the form—

$$X_W[\mathrm{k}] = \sum_{i=1}^{p} [\mathrm{A}_i/2\,(W(\mathrm{k/N} - (1+\alpha_i)\mathrm{M}_i/\mathrm{N}))$$

$$+ \mathrm{A}_i^*/2\,(W(\mathrm{k/N} - (1-(1+\alpha_i)\mathrm{M}_i/\mathrm{N})))],$$

wherein

k is any bin of the predicted DFT,

A_i is the complex amplitude of the component in bin k,

p is the number of test tones in the test signal,

α_i is a ratio error in the sampling of the i^{th} test tone, and

$W(\mathrm{f}) = e^{(-j2\pi f(N-1)/2)} \sin(\pi \mathrm{fN}) / \sin(\pi \mathrm{f})$.

8. A method as recited in claim 7, wherein α represents an ideal, coherent sampling rate F_s divided by the actual sampling rate F_s', minus one, or $\alpha = F_s/F_s' - 1$.

9. A method as recited in claim 1, wherein the low-power components comprise noise and distortion in the test signal.

10. A method as recited in claim 1, wherein the step of adjusting the DFT includes subtracting a modeled spectral component from the value of each corresponding bin of the DFT.

11. An apparatus for measuring low-power components of non-coherently sampled test signals including at least one tone each having a known frequency, comprising:

means for executing a DFT of a sampled test signal;

means for modeling spectral components of the at least one tone, including effects of leakage induced by the at least one tone; and

means for adjusting the DFT by an amount prescribed by the modeled spectral components to generate a substantially leakage-free measure of noise and distortion in the test signal.

12. An apparatus as recited in claim 11, wherein plurality of known parameters include the number of cycles M_i of each test tone of the test signal within the sample window, the number of samples N within the sample window, and the sampling rate F_s.

13. An apparatus as recited in claim 12, wherein the modeled spectral components have substantially the form—

$$X_W[k] = \sum_{i=1}^{p} [A_i/2\,(W(k/N - (1+\alpha_i)M_i/N)) + A_i^*/2\,(W(k/N - (1-(1+\alpha_i)M_i/N)))],$$

wherein

k is any bin of the predicted DFT,

A_i is the complex amplitude of the component in bin k,

p is the number of tones in the test signal,

α_i is a ratio error in the sampling of the i^{th} test tone, and

$W(f) = e^{(-j2\pi f(N-1)/2)} \sin(\pi f N) / \sin(\pi f)$.

14. An apparatus as recited in claim 13, wherein α represents the ideal, coherent sampling rate F_s divided by the actual sampling rate F_s', minus one, or $\alpha = F_s/F_s' - 1$.

15. A method for testing the a non-coherently sampled test signal including at least one tone each having a known frequency, comprising:

applying a stimulus signal to an input of a device under test;

sampling a test signal from an output of the device under test;

executing a DFT on the sampled test signal;

modeling the spectrum of the at least one tone, including effects of leakage induced by the at least one tone; and

adjusting the DFT by an amount prescribed by the modeled spectrum to generate a substantially leakage-free DFT of the test signal.

16. A method as recited in claim 15, further comprising comparing bins of the adjusted DFT with one or more threshold levels to determine whether the device under test passes or fails.

17. A method as recited in claim 16, further comprising testing a plurality of devices.

18. An apparatus for testing a non-coherently sampled test signal including at least one tone each having a known frequency, comprising:

a stimulus circuit for applying a stimulus signal to an input of a device under test;

a sampling circuit for sampling a test signal from an output of the device under test;

means for executing a DFT on the sampled test signal;

means for modeling the spectrum of the at least one tone, including effects of leakage induced by the at least one tone; and

means for adjusting the DFT by an amount prescribed by the modeled spectrum to generate a substantially leakage-free DFT of the test signal.

19. An apparatus as recited in claim 18, further comprising means for comparing bins of the adjusted DFT with one or more threshold levels to determine whether the device under test passes or fails.

20. An apparatus as recited in claim 19, further comprising means for testing a plurality of devices.